



**PATENT**  
Attorney Docket No. 207617  
Client Reference No. 99106

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of:

Dirksen et al.

Art Unit: 1765

Application No. 09/737,905

Examiner: Kin-Chan Chen

Filed: December 15, 2000

For: METHOD OF POLISHING OR  
PLANARIZING A SUBSTRATE

**DECLARATION UNDER 37 C.F.R. § 1.132 OF  
JAMES A. DIRKSEN**

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I, James A. Dirksen, hereby declare that:

1. I am an employee of Cabot Microelectronics Corporation and one of the co-inventors of the subject matter disclosed and claimed in the subject patent application.
2. In order to illustrate the effects of the total surface hydroxyl group density of a silica abrasive on the polishing of a substrate comprising tungsten, the surfaces of six similar substrates comprising tungsten were polished with six different compositions comprising a silica abrasive and a liquid carrier. Each of the substrates was polishing using similar polishing parameters.
3. Each of the compositions (Compositions 1-6) comprised similar amounts of silica abrasive and similar amounts of liquid carrier. However, the silica abrasive present in each of the compositions had a different total surface hydroxyl group density as follows:

Composition	Total Surface Hydroxyl Group Density (hydroxyl groups per nm <sup>2</sup> )
1	3.2
2	3.05
3	2.93
4	2.78
5	2.76
6	2.55

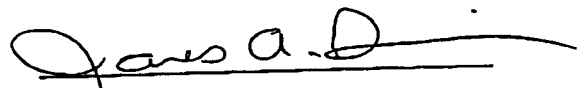
4. After the substrates were polished, each of the substrates was analyzed to determine the relative number of defects on the surface of the substrate.

5. The results of the defectivity measurements demonstrated that the substrates that were polished with compositions comprising silica abrasives having total surface hydroxyl group densities greater than approximately 3 hydroxyl groups per  $\text{nm}^2$  (i.e., Compositions 1 and 2) exhibited surface defectivities that were at least about 225% greater than the surface defectivities of the substrates that were polished with compositions comprising silica abrasives having total surface hydroxyl group densities less than approximately 3 hydroxyl groups per  $\text{nm}^2$  (i.e., Compositions 3-6).

6. In particular, the substrate that was polished with a composition comprising a silica abrasive having a total surface hydroxyl group density of approximately 3.05 hydroxyl groups per  $\text{nm}^2$  (i.e., Composition 2) exhibited a surface defectivity that was approximately 600% greater than the surface defectivity of the substrate that was polished with a composition comprising a silica abrasive having a total surface hydroxyl group density of approximately 2.93 hydroxyl groups per  $\text{nm}^2$  (i.e., Composition 3).

7. I hereby declare that all statements made herein of my own knowledge are true, that all statements made on information and belief are believed to be true, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: 10/06/04

  
James A. Dirksen